TITLE: Micrometeoroid Impacts and Optical Surface Scatter in Space Environment

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Abstract:

This presentation will discuss the results of an attempt to use laboratory test data and empirically derived models to quantify the degree of surface damage and associated light scattering that might be expected from hypervelocity particle impacts in space environment. Micrometeoroid sizes are predicted to be predominantly in the mass range 10^{-5}g or less, with most having diameters near 1μm, but some larger than 120μm, with velocities near 20km/s. In a laboratory test, latex (ρ = 1.1. g/cm^3) and iron (7.9 g/cm^3) particles with sizes ranging from 0.75μm to1.60μm and with velocities ranging from 2.0km/s to 18.5 km/s, were shot at a dielectric coated gold mirror. Scanning electron and atomic force microscopy were used to measure crater dimensions that were then associated with particle impact energies. These data were then fitted to empirical models derived from solar cell and other spacecraft surface components returned from orbit, as well as studies of impact craters studied on glassy materials returned from the lunar surface, to establish a link between particle energy and impact crater dimension. Published estimates of the Martian and Saturnian meteoroid environments were used as the sources of particle flux estimates. From these data, an estimate of total expected damaged area was computed and this result produced an estimate of expected surface scatter from the modeled environment.